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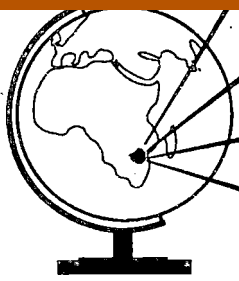

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THE RAILWAYS AND THE ZIMBABWE COAL CRISIS OF THE LATE 1980s

by

C. KUNAKA

University of Zimbabwe

INTRODUCTION

Zimbabwe experienced severe coal shortages in the late 1980s when the National Railways of Zimbabwe (NRZ) failed to transport coal from the single colliery (Wankie) then in operation in the country to the consumption centres. This caused problems in a number of industries across the country. Some industries, particularly the tobacco, electricity generation, and sugar industries, which use a lot of coal in their operations were seriously affected. The aim of this paper is to discuss the problems experienced by the NRZ as highlighted during this coal crisis which reached a peak in 1988 and 1989.

Transport organisations exist to move people and/or goods such that demand is met as scheduled and safely. If they do not satisfy this basic principle then they would have failed. Although a variety of transport problems exist, those relating to the operation of transport systems have been researched more than those pertaining to engineering and the socio-political functions of transport. The former area of research includes problems with movement schedules, dispatch policies, vehicle sizes and routing patterns. For example, Crane (1968) explored the possibility of using aircraft simulation models to predict the movement of trains. Edwards (1975) modelled the operations of Britain's railway system in order to improve its operations, while Crainic, Florian and Leal (1990) have recently developed a general framework for improving railway operations in the movement of freight. This paper discusses some of the problems of railway operation common in developing countries using the railway system of Zimbabwe as a case study.

THE RAILWAYS AND NATIONAL TRANSPORT IN ZIMBABWE

There were several political and economic forces behind the development of railways in Southern Africa. The dominant of the two groups of forces is subject to debate (Gibb, 1991; Hanlon, 1984; Mwase, 1987). The initial political factor was Cecil Rhodes' concept of a Cape-to-Cairo railway line and this has been augmented by contemporary political objectives (Gibb, 1991; Griffiths, 1989). On the other hand, in Zimbabwe in particular, the

major economic factors were firstly, the desire to provide transport infrastructure to serve the emerging mining and farming enterprises from the late nineteenth century and secondly, to provide trade links to the seaports of Mozambique and South Africa for the landlocked country. Indeed, the railways have been an essential component of economic, social and political development with considerable influence on the Southern African regional space economy (Pirie, 1982).

The economic role of the railways in Zimbabwe has not changed much over the decades. This has been identified as being to 'provide and maintain ... an efficient system of public transport of goods and passengers by rail' (Rhodesia Railways Act, 1973). The system developed as an integral part of the national economy such that it had to be nationalised in 1947 when the private owners, Rhodesia Railway (Pvt) Ltd, could not finance the rehabilitation required after it had been run down during the Second World War.

Infrastructure

Line construction started in 1892 from Mozambique and in 1893 from South Africa and all the main and major branch lines were constructed over the next 30 years to lay the framework of the present network (Figure 1). The lines focussed on the major urban centres of Salisbury (now Harare), Bulawayo, Gwelo (Gweru) and Umtali (Mutare) and traversed through the main farming and mining regions of the country. There have been only a few minor additions to this initial alignment. Today the total route distance is 2 759 km of which over 90% is single track while some 1 575 km are managed through a centralised train control system. Some 311 km of the track are electrified.

In 1989 the NRZ owned 422 locomotives and 13 231 freight wagons (NRZ, 1989). The locomotives consisted of 88 steam, 304 diesel and 30 electric locomotives. The steam locomotives were mainly used on the southern section of the network close to Wankie colliery in the northwest of the country, both for mainline operations and for shunting purposes in the marshalling yards. (The southern section is the part of the network from Bannockburn, 79 km southwest of Gweru through Bulawayo to Hwange in the northerwest and Plumtree in the west – see Figure 1). The electric locomotives are exclusively for the electrified section between Dabuka near Gweru and Harare while the diesel locomotives are extensively used on all sections of the network.

The freight wagons on the system are generally classified into three categories: highsided, dropsided, and covered wagons. In 1989 these numbered 7 540, 2 358 and 1 154 wagons respectively. The remainder of the total

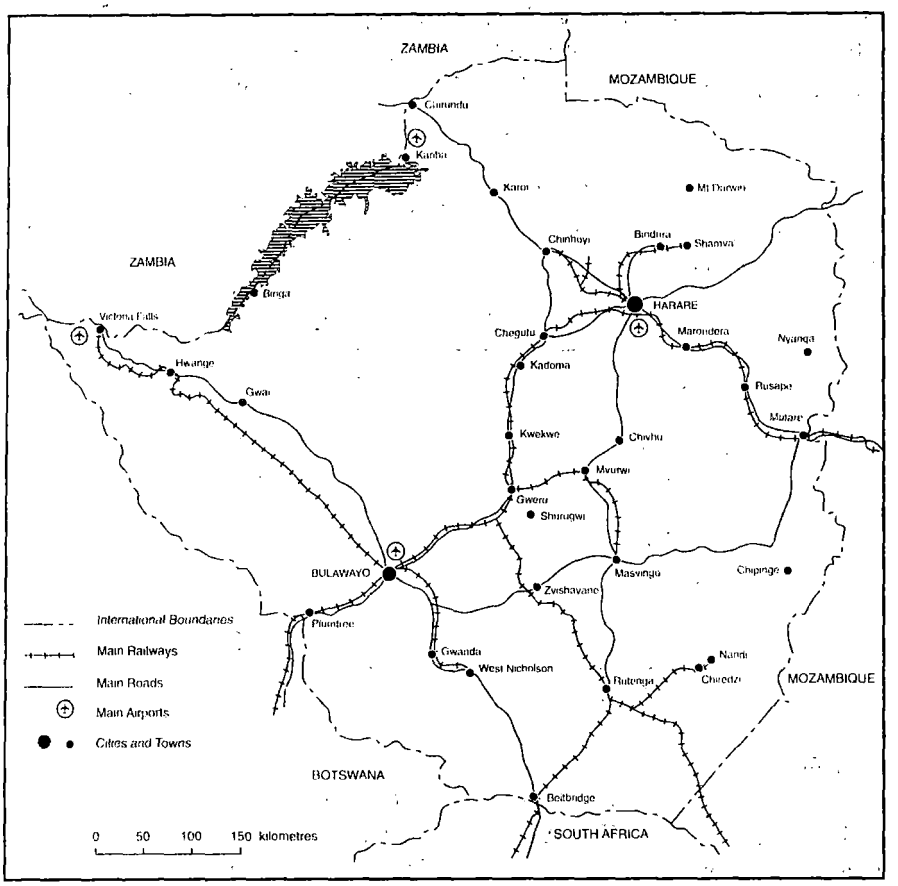

Figure 1: Major transport routes in Zimbabwe

wagon stock comprised specialised container, livestock, refrigerator, tank, and explosives wagons. Whilst the highsided general purpose wagons are used for conveying general cargo such as cement, coal, maize, sugar and wheat, dropsided wagons are ideally suited to carrying heavier commodities like asbestos, copper, salt, stones, and other heavy metal products. The NRZ stock of wagons is usually supported by a strong contingent of South African wagons which averaged 6 700 per day in 1989 (NRZ, 1989).

Traffic is hauled mostly between pairs of around 640 private terminals (Turton, 1988). The five large marshalling yards which are an important part of the system are located at Hwange, Bulawayo, Gweru, Harare and Mutare. The Dabuka marshalling yard in Gweru forms the hub of the operations of the NRZ operations as a central traffic sorting yard while the Harare yard at Lochinvar also serves as the container terminal for the railway network. Table 1 shows the wagon flow capacities in one direction for the five

marshalling yards. The capacities do not represent the actual traffic dealt with, as the latter is generally well below these expected maximum amounts (NRZ, 1989; Swedish International Development Agency, 1985).

TABLE 1:
NRZ MARSHALLING YARDS WAGON FLOW CAPACITIES PER DAY

Yard	Number of wagons per day (one-way)
Thomson Junction (Hwange)	630
Mpopoma (Bulawayo)	1 000
Dabuka (Gweru)	3 000 to 4 000
Lochinvar (Harare)	860
Mutare	384

Source: NRZ, 1989

Traffic

The NRZ carries about 90% of all domestic medium to long distance freight in the country (SIDA, 1985). The amount of freight traffic carried over the past twenty years is shown in Figure 2. The railway still serves its initial role as a means for promoting industrial, agricultural and mining activities as reflected in its traffic composition of which minerals comprised 20% and agricultural products 27% of total freight carried in 1989 (NRZ, 1989).

The internal freight composition is dominated by shipments of coal and iron ore. These two traffic types started receiving particular attention from 1975 when specialised wagons were introduced for their movement (Croxton, 1982). The operations of these "liner trains" are, however, largely focussed on the iron and steel plant at Redcliff near Kwekwe. On average coal accounted for 23% of the total freight carried each year between 1986 and 1989. The movements of other types of traffic are more dispersed as a result of the spatial distribution of mining, farming and industrial activities.

THE RAILWAYS AND THE MOVEMENT OF COAL

Coal was first discovered in the Hwange area of Zimbabwe in 1893 though shaft sinking only began in 1901 and the coal seam was reached in

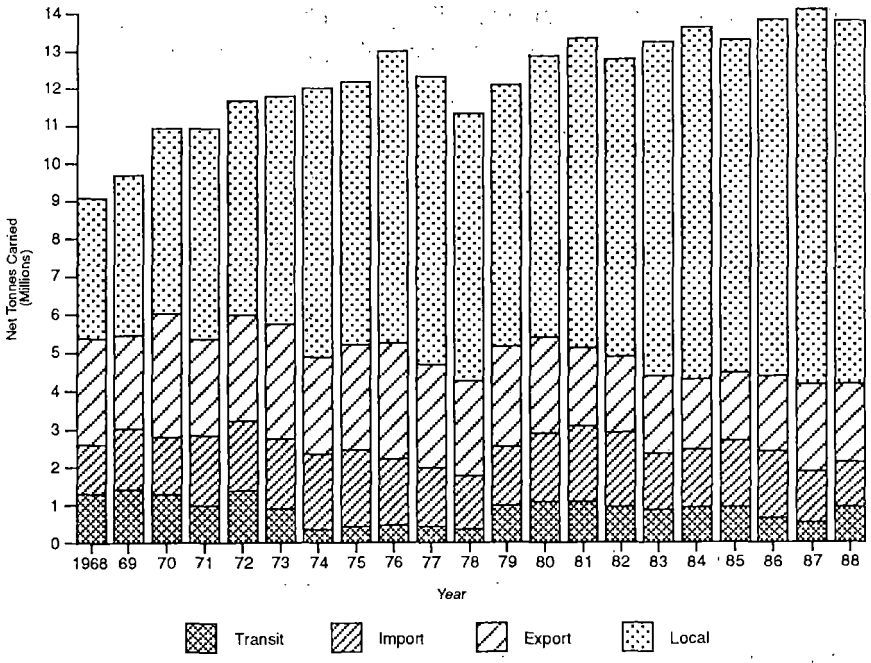

Figure 2: Freight carried by the NRZ, 1968 – 1988
(Net tonnes excluding on-rail services)
Source: NRZ, 1989

1902 (Government of Rhodesia, 1973). The present estimated coal reserves in the country are 30 000 million tonnes distributed over 23 fields (Economist Intelligence Unit, 1988). However, production is still largely from one colliery, the Wankie Colliery at Hwange (Figure 1). Production from this colliery averages some 4 million tonnes per annum, while the recently developed colliery at Sengwa, south of Lake Kariba, is expected to produce 200 000 tonnes yearly.

The main users of coal in the country are the paper production, mining, textile, sugar refining, tobacco farming and electricity generation industries. The electricity generation industry is the single largest consumer especially after a big thermal power station in Hwange was brought on-line in two phases in 1983 and 1987.

Most of the other major coal consumers are urban-based industries to the east of the colliery. Table 2 shows estimated coal consumption by town and its hinterland in 1988/89. The railway moves most of the coal using a wagonload system. This is because the fairly large volumes and distances involved give the railway a competitive advantage over other modes of

transport. Coal deliveries from the colliery to each major destination average 15 000 tonnes per annum over a distance of 485 km (Kunaka, 1990).

TABLE 2:
APPROXIMATE COAL CONSUMPTION FOR SELECTED CENTRES, 1988/89

Town	Coal consumed in '000 tonnes
Bulawayo	385
Harare	285
Munyati	220
Gweru	60
Chinhoyi	48
Mutare	32
Marondera	19

Source: NRZ, 1989.

Past coal movement problems

The operations of the Wankie Colliery are 'irrevocably interlocked with that of the railways, on which colliery clearance and expansion depends' (Government of Southern Rhodesia, 1949). There have, however, been instances when the railways have not been able to provide adequate clearance of coal at the colliery.

The first notable coal crisis in Zimbabwe occurred soon after the end of the Second World War in 1945. During the war period the country's railways had enjoyed a boom in both passenger and freight traffic (Table 3). The large increases in traffic were a result of movements of troops and war materials. Restrictions on private fuel consumption during the war years also contributed to the increase in the number of passengers carried.

The increases in traffic combined with the small amounts of war-time capital expenditure resulted in the running down of the system by the end of the war. At the same time, the war had stimulated local industry which continued to grow after 1945, resulting in an increase in traffic for the railway company (Croxton, 1982). The post-war industrial expansion also resulted in increased imports of plant and machinery through Mozambican and South African ports (Rhodesia Railways, 1947). There was a particularly strong movement of import traffic from South Africa northwards into the country. The railway found it difficult to cope with the demand with the existing wagon stock and this was exacerbated by congestion in the yards, resulting

TABLE 3

CHANGES IN TRAFFIC MOVED BY THE RAILWAYS, 1939 and 1944

	1939	1944	% change
Tonnages	3 118 782	4 658 222	+49.4%
Passengers	1 021 758	2 486 315	+143.3%

Source: Croxton, 1982.

in long wagon turn-round times. (Turn-round time is defined as the time period between consecutive wagon loadings and is usually measured in days). South African wagons and locomotives were then employed to deal with the rise in traffic (Croxton, 1982). However, the railway found it increasingly difficult to move its own wagons into the southern section of the network as the number of South African wagons increased, resulting in a shortage of domestic wagons in this section (Rhodesia Railways, 1947). By the late 1940s the country was experiencing some coal shortages because the railway could not supply enough wagons for loading at the Wankie colliery. The shortage was exacerbated by the drought in 1947 which resulted in the redirection of railway wagons to ferry drought relief food to affected areas (Rhodesia Railways, 1948). The reduced colliery loadings adversely affected power production and also resulted in some coal-intensive mining operations being curtailed. Small consumers were particularly affected with the railways receiving numerous complaints of late coal deliveries (Government of Southern Rhodesia, 1949).

A variety of strategies were adopted by both the colliery and the railways to solve the coal problem in the late 1940s. The railways imposed embargoes on the use of South African wagons on its system as this would allow its own wagons to be moved through the southern section of the network to the Wankie Colliery. Some wagons normally used to carry chrome were employed in the short-term to ferry coal from the colliery to the principal consumption centres. Coal consumers were also encouraged to off-load wagons quickly to reduce wagon turn-round times.

At Wankie, the daily requirement of 322 coal wagon loadings was higher than the colliery's loading capacity and mechanical coal handling facilities had to be installed to cope with the demand (Croxton, 1982). In addition the government encouraged consumers to stockpile coal in case of future inability to deliver by the railways (Government of Southern Rhodesia, 1949). The colliery also established storage facilities to assist in loading and

improve wagon turn-round. The coal problem was, however, to repeat itself in the late 1980s.

The 1988-89 coal crisis

In the late 1980s the NRZ appeared, at least in theory, to have the capacity to cater for future increases in traffic. Both the yards and tracks were operating below their design capacities. However, even though there were no dramatic rises in traffic in 1988 and 1989, the corporation found it difficult to cope with the demand for its services. The performance measures of the corporation rapidly deteriorated. The average turn-round time for all wagons rose from 11.9 days in 1988 to 14.1 days in 1989 (NRZ, 1989). Even more dramatic was the drop in average wagon-kilometres per day, a measure of wagon use similar to turn-round time, which fell from 55 wagon-kilometres per day in 1986 to 42 wagon-kilometres per day in 1989 (Figure 3).

A wagon census in late 1988 showed that on average 80% of all wagons were lying idle in a marshalling yard on any one day (NRZ, 1989). During the 1988-89 financial year the railways had a massive operating deficit of

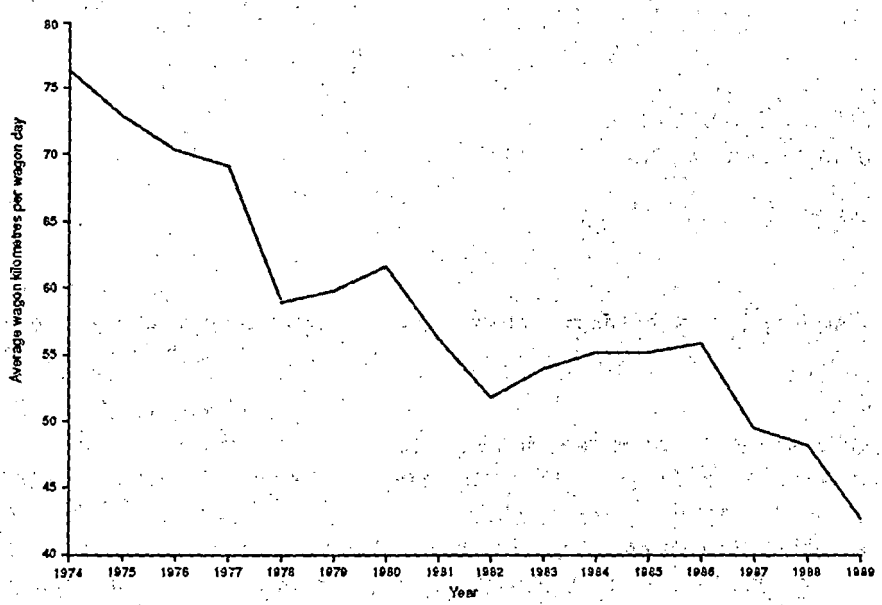

Figure 3: NRZ – Average wagon-kilometres per day, 1974–1989

Source: NRZ *Annual Reports*

ZW$116 million as well as receiving a record number of customer complaints (NRZ, 1989). The large number of South African wagons and locomotives on the NRZ network also reflected its poor performance. South African wagons averaged 6 700 per day in 1989 whilst ideally, they should not exceed 3 000 (Kunaka, 1990). The failure of the railways was most apparent in its coal operations.

From the mid-1980s, culminating in the crisis of 1988/89, the railways was unable to move the coal requirements of the main consumers as per scheduled demand. The inconsistencies and delays in delivery resulted in considerable disruptions to industrial operations in the major centres of the country. For example, in late 1988 some companies which use a lot of coal resorted to shorter working weeks while the national electricity generation corporation had to temporarily shut down one of its thermal power stations when coal reserves ran low. In May 1989 the colliery itself was on the brink of closure when wagon loadings fell to 50% of their normal levels and coal storage costs increased sharply as a result of the accumulation of large stocks on site (EIU, 1989). Even in mid-1990 the sugar refining industry in the country was still reporting that deliveries were on average 14 days behind schedule while the electricity corporation reported severe coal shortages at three of its four thermal power stations, with one having only eight days supply of coal for power generation (Kunaka, 1990). The only thermal power station not affected by the shortage was the one located at Hwange which is fed directly from the colliery by a conveyor belt.

The National Railways of Zimbabwe (NRZ) blamed its unreliable coal freight operations on a shortage of both wagons and locomotives. Some of the main consumers, particularly the Confederation of Zimbabwe Industries, the Zimbabwe Sugar Association and the Zimbabwe Electricity Supply Authority also gave the same reasons as the major causes of the shortage of coal (Kunaka, 1990). The operational causes of the crisis are discussed below.

Causes of the 1980s crisis

The coal crisis of the late 1980s was a product of similar problems to those of the late 1940s. A number of interrelated factors can be identified.

Firstly, the railway experienced a boom in traffic in the mid-1970s (Figure 2) with traffic levels only surpassed in the late 1980s. This was a repetition of the boom of the early 1940s and is likely to have contributed to a similar wearing down of the system. The civil war in the country in the late 1970s also contributed to the deterioration of the system through sabotage and the lack of proper maintenance and capital investment.

Secondly, the railway system which had been rehabilitated in the 1950s was worn down by the 1980s given the expected economic life of locomotives, in particular the diesel and steam locomotives. For example, in 1988 the engines broke down on average once every 7 300 km for steam locomotives, every 16 000 km for diesel and every 53 000 km for electric locomotives compared to ideal rates of 15 000, 50 000, and 60 000 km respectively (NRZ, 1988). This resulted in poor locomotive availability. The NRZ (1989) identified a number of related contributory factors pertaining to maintenance problems. These included locomotives spending too much time on maintenance due to lack of spare parts, backlogs in maintenance with an average of only 185 of the total engine stock actually running at any given time, and poor maintenance quality arising from inadequately skilled staff as it was difficult to replace white retirees. The shortage of foreign currency was a strong contributory factor to the maintenance and stock replacement problems of the railway.

Thirdly, the number of South African wagons on the system was relatively high, causing wagon distribution problems as in the earlier crisis. Some of the South African stock had been brought in as a temporary measure to alleviate NRZ shortages as a result of foreign currency problems. The South African wagons had to be constantly moved southwards towards South Africa as the NRZ paid for the time they spent on its system (Chiwara, 1988). This had the effect of delaying the movement of the NRZ's own wagons on the same tracks, given the single track system.

Fourthly, the coal crisis coincided with the breakdown of the Kafue hydro-electric power station in Zambia from where some electrical power is imported into Zimbabwe. The breakdown at Kafue necessitated an increase in local power production from Zimbabwe's own thermal stations, entailing increased coal requirements.

Fifthly, new regional transport requirements brought about by the independence of Zimbabwe and the formation of the Southern African Development Co-ordination Conference (SADCC) also contributed to the crisis. One of the major objectives of SADCC through its Southern African Transport and Communications Commission (SATCC) has been to reduce the use of the South African transport system by its member states (SADCC, 1988). However, most of the railway systems in the SADCC countries are relatively inefficient as illustrated by differences in average turn-round times for NRZ wagons entering the South African system and the other regional systems (Table 4). The increased use of these other systems with their high turn-round times meant a reduction in the number of wagons available for loading within Zimbabwe itself, although the total number of NRZ wagons on the Mozambican, Zairean and Zambian systems was not very large.

TABLE 4:
AVERAGE WAGON TURN-AROUND TIMES FOR NRZ WAGONS ON OTHER REGIONAL RAILWAY SYSTEMS, 1989

Country	Turn-round time in days
RSA	8
Botswana	8
Mozambique-Beira line	12
Mozambique–Maputo line	14
Zambia/Zaire	26

Source: NRZ, 1989.

A combination of the above factors resulted in the available wagons spending considerable amounts of time in sidings or yards awaiting locomotive power. A simulation study in 1990 showed that the major manifestation of the problems experienced by the railway in the late 1980s was the excessive delays to wagons in the marshalling yards (Kunaka, 1990). The longer the delays encountered by a wagon fleet the larger the total number of wagons that were required to move the traffic even if that traffic remained constant. Kunaka (1990) found that the tracks were coping well even though the system is largely single track. They were, therefore, not responsible for the delays experienced in freigh movement.

Solutions to the late 1980s crisis

The railways obviously required considerable amounts of money for capital expenditure to replace its old stock, in particular locomotives and wagons. An operations improvement plan drawn up in late 1989 addressed a variety of problems that had been identified (NRZ, 1989). One of strategies was the re-organisation of the corporation to give more authority to its regional offices and reduce bureaucracy. The other main issues considered in the plan are discussed below under three sub-headings: locomotives, wagons and marshalling yards.

A programme to rationalise the locomotive types from the 13 which were in operation up to the crisis to 3 or 4 types was proposed. This strategy has two obvious attractions. It would make the acquisition of locomotives and spare parts easier and would streamline maintenance procedures.

One of the first strategies with respect to wagons was to reduce the number of South African wagons within the NRZ system. This would cut down on the costs incurred in using these wagons as well as make movement

and monitoring of the NRZ's own wagons easier by de-congesting the system. Wagons specifically designed to carry certain types of freight were to be introduced with the aim of achieving efficiency in their use and reducing underloading which had been a regular occurrence in the past. Internal demurrage, that is charging railway departments or sections, was also introduced in order to avoid excessive hold-ups of wagons within the railways. Wagons were also to be scraped and replaced on time in order to cut down on maintenance of obsolete stock and to free the tracks.

Proposed yard strategies varied from streamlining operations to improvement of the productivity of train crews. Trains were to be dealt with on a first-in-first-out basis, thus running trains on the dictates of traffic. In addition, the railways was to run wagons with similar freight or common destinations as blocks to reduce the need for shunting during a train journey. The other major yard strategy was to create more re-fuelling and crew exchange facilities within the yards in order to speed up operations by cutting down on the time taken to perform such activities.

A long-term plan has also been drawn up for the railways. The plan focusses mainly on replacing and modernising the railway rolling stock and was expected to cost ZW$700 million over a ten-year period from 1989 (The Herald, 5 April 1991). The programme has obtained World Bank backing and is expected to result in the full implementation of the above strategies and particularly the replacement of locomotives and wagons as well as signal and other control systems. The plan is intended to improve the general operations of the NRZ, and not just its freight operations. The effects of some of the short-term strategies aimed at improving operations are already beginning to emerge. By early 1991 the NRZ could point to two main achievements arising from the strategies which had been adopted to deal with the problems it faced (The Herald, 30 April 1991). These were, firstly, the reduction in the number of South African wagons to 2 000 and secondly, 70% of the traffic was now being ferried directly between origin and destination thereby reducing transit times. Some shippers were getting their goods within 48 hours of the start of a shipment.

CONCLUSION

Coal was not the only type of freight traffic experiencing movement problems during the period under review. Rather it was the most significant traffic affecting a number of industries simultaneously and exposing some of the major weaknesses in Zimbabwe's railway system. The initial improvements to operations initiated in 1989 were achieved by streamlining procedures and restructuring operations without any new infrastructure being injected. The short period within which these preliminary improvements

were made suggests that some of the major causes of the crisis were internal to the railways and included the management structure of the NRZ. Transport organisations in developing countries, especially large ones such as the railways, suffer from a number of management problems reflected in short-sighted planning, lack of proper operational goals and persistent crisis management.

The relationship between transport and the economy in developing countries is also influential in amplifying the problems of rail traffic movement. This arises from domination of some categories of traffic by one mode of transport. If that mode experiences short-term problems the effects on the economy under such monopoly conditions will be much greater compared to those experienced under more competitive transport regimes.

The major transport problems in most developing countries are those of poor management, insufficient maintenance and delayed replacement of stock. The principal cause of the latter problem is lack of finance within the country in general, but even more important, in the transport sector. Once the basic infrastructure has been provided there is usually a lack of commitment on the part of governments to provide adequate funding for maintenance purposes. In most cases this is because maintenance does not allow for the "public tape cutting" which goes with the initial opening of such infrastructure and it therefore drops in priority in the allocation of scarce national resources. The benefits of regular maintenance of transport infrastructure are less obvious than when a facility is first constructed. So transport problems degenerate to crisis dimensions before they are dealt with. Unfortunately, this may result in sub-optimum solutions or concentration on short-term solutions which may only serve to reduce the gravity of the situation. Though long-term plans can be drawn up as in the case of the NRZ, full implementation of such plans is not usually carried out.

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